

FEE BASIS PTO-1390 (Modified) (Rev. 11-98)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER <b>503235-25</b>
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.5) <b>09/701900</b>
INTERNATIONAL APPLICATION NO. <b>PCT/NO99/00187</b>	INTERNATIONAL FILING DATE <b>7 June 1999 (07.06.99)</b>	PRIORITY DATE CLAIMED <b>8 June 1998 (08.06.98)</b>		
TITLE OF INVENTION <b>METHOD AND APPARATUS FOR DRYING A POROUS MATRIX</b>				
APPLICANT(S) FOR DO/EO/US <b>JONASSEN, Ola, STROMMEN, Ingvald, SCHIEFLO, Per Arne, ODILIO, Alves-Filho</b>				
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:				
<ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li>4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2))             <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li>6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li>7. <input checked="" type="checkbox"/> A copy of the International Search Report (PCT/ISA/210).</li> <li>8. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))             <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> have been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li>9. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>10. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).</li> <li>11. <input checked="" type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409).</li> <li>12. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).</li> </ol>				
Items 13 to 20 below concern document(s) or information included:				
<ol style="list-style-type: none"> <li>13. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>15. <input type="checkbox"/> A <b>FIRST</b> preliminary amendment.</li> <li>16. <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</li> <li>17. <input type="checkbox"/> A substitute specification.</li> <li>18. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>19. <input type="checkbox"/> Certificate of Mailing by Express Mail</li> <li>20. <input type="checkbox"/> Other items or information:</li> </ol>				

EK839442275US

21. The following fees are submitted:		<b>CALCULATIONS PTO USE ONLY</b>	
<b>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :</b> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1000</li> <li><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO ..... \$840.00</li> <li><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$690.00</li> <li><input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$670.00</li> <li><input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$96.00</li> </ul>			
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b> <b>1000</b>			
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than		<input type="checkbox"/> 20	<input type="checkbox"/> 30
		<b>\$0.00</b>	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	2 - 20 =	0	x \$18.00 <b>\$0.00</b>
Independent claims	- 3 =	0	x \$78.00 <b>\$0.00</b>
Multiple Dependent Claims (check if applicable).		<input type="checkbox"/> <b>\$0.00</b>	
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		<b>SUBTOTAL =</b>	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than		<input type="checkbox"/> 20	<input type="checkbox"/> 30
		+ <b>\$0.00</b>	
<b>TOTAL NATIONAL FEE =</b>		<b>\$970.00</b>	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).		<input type="checkbox"/> <b>\$0.00</b>	
<b>TOTAL FEES ENCLOSED =</b>		<b>1000</b>	
		<b>Amount to be: refunded</b>	<b>\$</b>
		<b>charged</b>	<b>\$</b>
<input type="checkbox"/> A check in the amount of _____ to cover the above fees is enclosed.  <input checked="" type="checkbox"/> Please charge my Deposit Account <b>5-1145</b> in the amount of <b>1000</b> (Order No. <b>503235.093800</b> ) to cover the above fees. A duplicate copy of this sheet is enclosed.  <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. _____ A duplicate copy of this sheet is enclosed.			
<p><b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b></p> <p>SEND ALL CORRESPONDENCE TO:</p> <p><b>Joseph C. Sullivan</b>  Pitney, Hardin, Kipp &amp; Szuch LLP  711 Third Avenue  New York, New York 10017  212-687-6000</p>			
 <b>SIGNATURE</b> <hr/> <p><b>Joseph C. Sullivan</b></p> <hr/> <p><b>NAME</b></p> <hr/> <p><b>18,720</b></p> <hr/> <p><b>REGISTRATION NUMBER</b></p> <hr/> <p><b>December 4, 2000</b></p> <hr/> <p><b>DATE</b></p>			

Method and apparatus for drying a porous matrix

The present invention is related to a method and an apparatus for producing a porous matrix from a solution, a paste, 5 an extract, a granulated material or such, and the drying process.

Developments are continuously made to make processes and apparatus and connectors with freeze drying more economical, more accurate, to a higher degree capturing aromatic and 10 nutritious ingredients during the freeze drying process.

With the method and the apparatus according to present invention, the dryer may operate at different temperature levels and inlet conditions below the freezing point of the material, enabling removal of substantial amount of moisture within a 15 shorter residence time.

With the method according to the present invention is provided a flexibility on the operation since a solution, a suspension, a paste, juices, extract and even finely granulated sticky products can be mixed with an inert agent and expanded as 20 to form a porous matrix. Said porous matrix is progressively dried as it is introduced into the drying chamber, said drying chamber thereby comprising means to adjust the inlet conditions as provided by the heat exchanger and the blower.

By closed loop circulation of the drying air or other 25 media, processing contaminations are avoided and a maximum retention of the final product aroma or odorants as well as other heat sensitive organic components, which would have been lost in open processes.

Uncoupled heat exchangers provide conditioned drying 30 media at appropriate and different levels as to attain minimum thermal inactivation while avoiding degradation of heat sensitive or delicate products. To avoid environmental and thermal pollutions, natural refrigerants are used in the uncoupled heat exchangers.

35 The above described advantages are achieved with the method and the apparatus according to the present invention as defined with the features stated in the claims.

The drawing discloses in Figure 1 schematically an apparatus according to the invention and Figure 2 discloses

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enlarged a control valve used in the apparatus in Figure 1.

According to the invention, an inert agent is introduced into the structural raw material which may be a solution, a paste, an extract, a granulated material or such, 5 whereafter the raw material is expanded to above or below the freezing point of the raw material and to a lower pressure, thereby producing a matrix mainly consisting of solids, pores and ice crystals. The resulting matrix may be frozen prior, or during the drying process or may be directly introduced into drying 10 chamber.

The frozen matrix is placed into the drying chamber of the apparatus whereafter the dryer is activated. The moisture removed from the matrix is guided as an exhaust medium through a heat exchanger having cooled surface coils in which the water 15 vapour condenses and thereafter is removed from the drying circuit.

In the next phase the drying medium is conditioned to the desired and preset inlet condition of the drying chamber by using the heated surface of the heat exchanger. This process is 20 repeated continuously as the drying medium is reentered the drying chamber containing the matrix.

With the apparatus according to the present invention the inert agent is mixed with a matrix in a controlled mixing process. For this purpose the apparatus comprises several 25 components also for conditioning the drying medium.

Reservoir 1 for the inert agent and reservoir 2 for the raw material are preferably made of stainless steel. The outlet of said reservoirs is accurately controlled for fine proposing of the mass fractions, by the use of flow meters and control 30 valves. Pressure and temperature at the reservoir inlets and outlets are recognized by sensors and indicators arranged in the reservoir piping, fittings and connections.

The dryer as such consists of a closed loop in which the drying medium flows after being conditioned in the heat 35 exchanger. The surfaces of the heat exchanger may be independently heated respectively cooled or may as such be connected with the appropriate refiguration systems and heat pumps.

A blower, when activated, provides the flow of the

drying medium through drying chamber containing the fixed or fluidized bed of porous frozen matrix, whereafter the drying as such is accomplished by heat transfer and mass transport mechanisms. The heated and cooled surfaces of the heat exchanger 5 promote dehumidification and conditioning of the drying medium and may be adjusted to provide desired specification and thermal sensitivity of the matrix by specific chamber designs and preset inlet conditions.

With the method and apparatus according to the present 10 invention the dryer is able to operate at different temperature levels and the inlet conditions may be preset at or below the final freezing point of the raw material, such that nearly all of the moisture in the matrix is removed. In connection therewith, the circuit temperature of the heat exchanger may be 15 changed in order to increase the temperature of the drying medium, controlling the relative humidity and consequently attaining a high degree of water removal and a short residence time of the matrix.

The design of the dryer as such enables use of only a 20 fraction of the energy used in conventional processes. Furthermore the closed drying circuit avoids contamination as such, as frequently observed with commercial open systems.

Due to the higher operation temperature and higher 25 operation pressure, the drying process according to the present invention is less expensive than commonly available drying systems having similar capacities. Furthermore the final product from the dryer provides higher and more uniform quality than conventional dryers and spray dryers operating at much higher temperature which furthermore is unsuitable for heat sensitive 30 materials.

The only figure discloses schematically the apparatus arrangement with its vital components. A liquid inert agent is fed into a vessel 5 at controlled pressure and amount through a valve 7. The valve 7 also permits dosing the amount of inert 35 agent inside vessel 5, as inspected through glass level indicator 8.

From the vessel 5 the pressurized liquid inert agent is transferred to the mixing vessel 4 which also receives the solution (paste, extract or granulated material) through an inlet

valve 10. The pressure and temperature inside the mixing vessel 4 is adjusted through the release valve 6. A multi-propeller agitator 9 rotates accordingly to provide a complete mixing of the inert agent with the solution.

5 From the mixing vessel 4, the solution is expanded into a porous matrix and is injected into drying circuit through the drying chamber 3. The matrix is kept suspended in the drying chamber by the flowing drying medium, which is supplied by the blower 2.

10 Besides keeping the porous matrix suspended during the process, the medium re-circulates the drying circuit in a closed loop. After removing the matrix moisture the exhaust medium is moved through a heat exchanger coil comprising a first heat exchanger 11 where the water vapour is condensed and removed from 15 the circuit. Thereafter the drying medium is adjusted to the desired inlet condition in the heat exchanger 1. Finally the drying medium flows through the matrix and the process is repeated.

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P a t e n t   C l a i m s

5        1. Method of drying a medium for producing a porous matrix from a solution, a paste, an extract, a granulated material or such, **CHARACTERIZED IN** feeding a liquid inert agent into a vessel (5) at controlled pressure and amount through a valve (7), transferring the pressurized liquid inert agent to a  
10 mixing vessel (4), said mixing vessel (4) also receiving the solution, such as paste, extract or granulated material, through an inlet valve (10), adjusting the pressure and temperature inside the mixing vessel (4) to desired levels by a release valve (6), upon complete mixing of the inert agent with the solution,  
15 the mixture is expanded into a porous matrix and injected into a drying circuit through a drying chamber (3), the matrix thereby being kept suspended in the drying chamber by the flowing drying medium, supplied by the blower 2, the matrix moisture being removed from the mixture through a heat exchanger coil comprising  
20 a first heat exchanger (11) where the water vapour is condensed and removed from the circuit and finally the drying medium is adjusted to the desired inlet condition in a heat exchanger (1) before the drying medium flows through the matrix and the process is repeated.

25        2. Apparatus adapted for drying a medium for producing a porous matrix from a solution, a paste, an extract, a granulated material or such, **CHARACTERIZED IN** the apparatus comprising a valve (7) being connected with a vessel (5) for feeding a liquified inert agent into the vessel (5) at controlled  
30 pressure and rate, the valve (7) thereby allowing dosing of the agent, a mixing vessel (4) being connected with the vessel (5) adapted to receive pressurized liquid inert agent as well as a solution such as a paste, an extract or a granulated material, through an inlet valve (10), a release valve (6) thereby  
35 controlling the pressure and the temperature inside the mixing vessel (4), an agitator (9) inside the mixing vessel (4) thereby ensuring complete mixing of the agent with the solution, a drying chamber (3) being connected with the mixing vessel (4) to receive the mixture as a porous matrix which thereby is injected into a

drying circuit through the drying chamber (3), and a first heat exchanger (10) being connected with the circuit for condensing and removing the water vapour from the circuit, the drying medium thereafter being adjusted to the inlet condition of the drying chamber (3) by a second heat exchanger (1).

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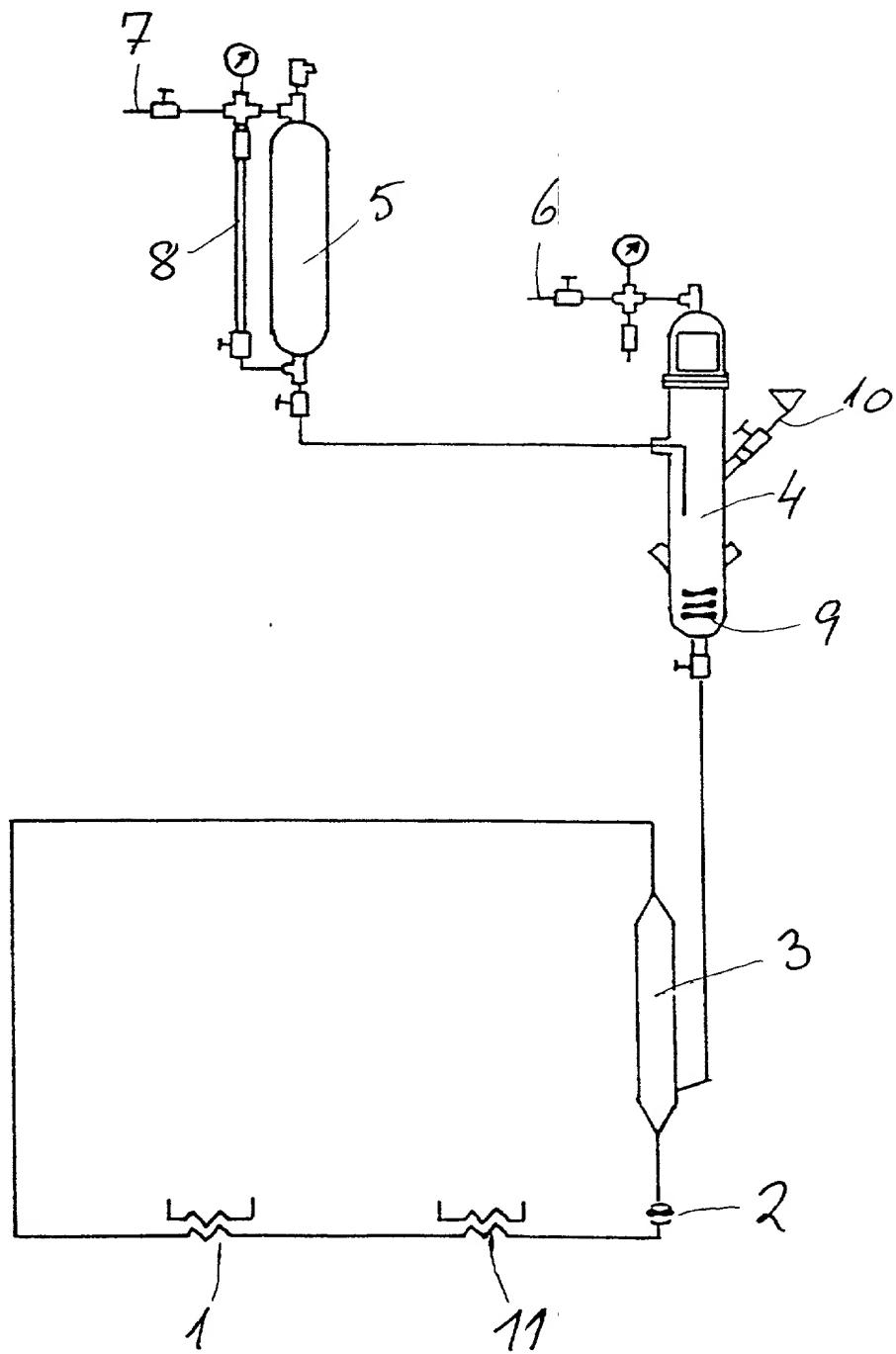
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PTO/901 (12-97)

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**DECLARATION FOR UTILITY OR  
DESIGN  
PATENT APPLICATION  
(37 CFR 1.63)**

Declaration Submitted with Initial Filing      OR       Declaration Submitted after Initial Filing (Surcharge (37 CFR 1.16 (e)) required)

Attorney Doctor Number	503235-25
First Name/Initials	JONASSEN, ola
CITY AND STATE OF RESIDENCE	
Application Number	/
Filing Date	
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as given below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is described and by which a patent is sought in the invention below.

**METHOD AND APPARATUS FOR DRYING A POROUS MATRIX**

The specification of which

Item of the Invention

 is attached hereto

OR

 was filed on 00/00/0000

June 7, 1999

as United States application Number or PCT International

Application Number PCT/2000/00187 and was filed on 00/00/0000 (if applicable).

I hereby state that I have reviewed and understood the contents of the above identified specification, including the claims, as converted by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim senior priority benefit under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or patent protection, or 365(d) of any PCT International Application, which designated at least one country other than the United States of America, whose filing date is later than the earliest priority date, by showing the date, any foreign application by name of inventor's certificate, affidavit, sworn declaration, and/or declaration, by showing the date, any foreign application by name of inventor's certificate, or of any PCT International Application having a filing date before that of the application on which priority is claimed.

Priority Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached Yes No
19982626	Norway	06.08.1998	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

 Additional foreign application numbers are listed on a supplemental priority claim sheet attached hereto.

I hereby declare under 35 U.S.C. 115 that I have read the above information contained in this declaration.

Application Number(s) Priority Date (MM/DD/YYYY)

Additional provisional application numbers are listed on a supplemental priority claim sheet PTO/902/02 attached hereto.

(Page 1 of 3)

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(July 1998)

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**Under the Patent Act of 1995, no patents are issued or registered in a trademark or service mark unless it is filed under this declaration.**

## DECLARATION — Utility or Design Patent Application

I hereby declare that there are 35 U.S.C. 120 of any United States application(s), or 365(d) of any PCT International application concerning the United States of America, from which this invention or each of the claims of this application is not disclosed in the prior United States or PCT International application or in the manner provided by the first paragraph of 35 U.S.C. 112. I acknowledge the duty to disclose information which is material to the examination of this application as defined in 37 CFR 1.56 which includes disclosure concerning the filing date of the prior application and the nature of PCT International filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (If applicable)
PCT/US99/00187	06.07.1999	

Additional U.S. or PCT International application numbers are listed on a supplemental sheet(s) attached hereto.

As a named inventor, I hereby declare the following regarding my participation in the preparation and/or review of this application and its submission to the Patent and Trademark Office concerned pursuant to:  Customer Number [REDACTED] →  **Customer Number or Bar Code Label**  
 Registered practitioner's name/practitioner number listed below

Name	Registration Number	Name	Registration Number
Joseph C. Sullivan	18,720	John F. Gibbons	33,180
Gerald Levy	28,419	Matthew W. Siegal	32,941
Ronald E. Santucci	28,398	Peter W. Latimer	46,858
Ronald E. DiPietro	32,200		

Additional registered practitioners (if any) whose names are listed above may be found on the following sheet(s) attached hereto.

Direct all correspondence to:  Customer Number or Bar Code Label OR  Correspondence address below

Name	Joseph C. Sullivan				
Address	Bitney, Hardin, Ripp & Sauch LLP				
Address	711 Third Avenue, 20th Floor				
City	New York	State	NY	Zip	10017
Country	U.S.A.				Telephone 212-687-6000 FAX 212-682-3485

I hereby declare that all statements made herein in my capacity as the sole or joint inventor(s) on this application and that are related to me (we); and further that these statements were made with full knowledge that such documents will be made public documents and that the facts contained herein are true and accurate to the best of my (our) knowledge, belief, and understanding, and that such facts will be used solely for the purpose of establishing the validity of the application for a patent by me (we).

Name of Sole or First Inventor:	<input type="checkbox"/> A division has been filed for this assigned inventor			
Given Name (first and middle name)				
Ola	Family Name or Surname			
Inventor's Signature	Ola Jonsen			
Residence City	State	Country	Date	23/4-2001
Post Office Address	NOX			
Post Office Address	Elgesbakkvei, N-2054 Bratsberg, Norway			
City	State	Zip	Country	
<input type="checkbox"/> Additional inventors are being named on the <b>Additional Inventor(s) sheet(s) attached hereto</b>				

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Under the Patent Act of 1995, no patent or trademark is issued in a classification of invention which is not  
within class general practice.

## DECLARATION

### ADDITIONAL INVENTOR(S) Supplementary Sheet Page 1 of 1

Name of Additional Joint Inventor, If any:

A power has been filed for this unsigned inventor

Given Name (first and middle if any)

Family Name or Surname

Torvald

Schjelde

Inventor's  
Signature

*Dagvald Stavlius*

Date

02.04.01

Residence: City

Country

Comments

NO

Post Office Address

*NOK*

Post Office Address: Veggstasjon 74, N-7051 Trondheim, Norway

City

State

Zip

Country

Name of Additional Joint Inventor, If any:

A power has been filed for this unsigned inventor

Given Name (first and middle if any)

Family Name or Surname

Bør Arne

Schjelde

Inventor's  
Signature

*N*

Date

NO

Residence: City

Country

Comments

NO

Post Office Address

Post Office Address: Odelaveien 6, N-7018 Trondheim, Norway

City

State

Zip

Country

Name of Additional Joint Inventor, If any:

A power has been filed for this unsigned inventor

Given Name (first and middle if any)

Family Name or Surname

Ogilie

Alveng-Pillay

Inventor's  
Signature

*Dagvald*

Date

Residence: City

Country

Comments

NO

Post Office Address

Post Office Address: Hvitstenveien 16F, N-7092 Kattset, Norway

City

State

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## DECLARATION

ADDITIONAL INVENTOR(S)  
 Supplementary Sheet  
 Page 1 of 3

Name of Additional Joint Inventor, if any:

A petition has been filed for this unsigned inventor

Given Name (first and middle if any)

Family Name or Surname

Inventor's  
Signature

Signature

Date

July 9, 2001

Residence City

City

Residence NO

Post Office Address

NOX

Post Office Address Osloveien 74, N-7053 Trondheim, Norway

City

State

Zip

Country

Name of Additional Joint Inventor, if any:

A petition has been filed for this unsigned inventor

Given Name (first and middle if any)

Family Name or Surname

Post Office

Signature

Inventor's  
Signature

Per A. Bludaa

Date

July 16, 2001

Residence City

City

Residence NO

Post Office Address

NOX

City

State

Zip

Country

Name of Additional Joint Inventor, if any:

A petition has been filed for this unsigned inventor

Given Name (first and middle if any)

Family Name or Surname

Post Office

Alves-Hille

Inventor's  
Signature

Alves-Hille

Date

Residence City

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(July 1998)